Final Project

Double Master's Degree

Industrial Engineering & Management Engineering

The Electric Vehicle Relocation Problem

MEMORY

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Abstract

Traditional car-sharing services are based on the two-way scheme, where the user picks up and returns the vehicle at the same parking station. Some services also allow one-way trips, where the user can return the vehicle in a different station. The one-way scheme is more attractive for users, but may pose a problem in the distribution of the vehicles, due to a possible unbalanced equation between the user's demand and the availability of vehicles or free slots at the stations. This issue becomes more complex in the case of electric car sharing, where the travel range depends on the state-of-charge of the vehicles. In a previous work [13], Bruglieri et al. introduced a new approach to relocate the vehicles where cars were moved by personnel of the service operator to keep the system balanced. Such relocation method generates a new challenging pickup and delivery problem called Electric Vehicle Relocation Problem (E-VReP). Consequently, Bruglieri et al. introduced a method to forecast the unbalancing of a car-sharing system [17]. They applied such method to the data yielded by the Milan transport agency, taking into account the location and capacity of charging stations in Milan. Finally, some years later, they introduced [29] the economic sustainability of the relocation approach, introducing a revenue associated to each request, and a cost associated with each operator.

In the proposed new model, authors want to add two new features to the E-VReP. The first one is the implementation of a working day with two work shifts. Until now each operator could start working at different times. With this new feature, we set two shifts each day, one in the morning, and one in the afternoon. The second novelty is the possibility for operators to collaborate among them. This means that operators can carpool in an EV in order to reach their destinations faster than if they tried reaching it by bike.

In this way, using a Mixed Integer Linear Programming (MILP) formulation of E-VReP, we can estimate the advantages of our relocation approach on verisimilar instances.


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Sumari

1. Glossary

E-VReP: Electric Vehicle Relocation Problem

EV: Electric Vehicle

MILP: Mixed Integer Linear Programming

2. Introduction and literature review

Car-sharing, understood as an organized form of shared use of the car, began to grow in Zurich in 1948 [30]. The original idea has been gradually replaced by an offer structurally organized according to strict business criteria, in order to achieve economies of scale, which resulted in increased benefits to users in terms of low rates and diversification of the available fleet.

The process of designing a car-sharing service pose several optimization problems, which have been tackled in the literature [31], in particular to determine the optimal size of the fleet and identify the location of the parking stations.

Due to environmental sustainability issues, nowadays, several carsharing companies are providing their customers with Electric Vehicles (EVs) rather than traditional internal combustion engine cars. Examples of real electric carsharing systems are: Car2Go (http://www.car2go.com/) in 25 cities around the world; Autolib (www.autolib.eu) in Paris, Lyon and Bordeaux; Autobleue (http://www.auto-bleue.org) in Nice-Côte d'Azur (France).

The planning and management of a carsharing service poses some important decision-making problems. As regards planning, two significant issues are the size of the fleet and the location of the parking stations [1–3]. On the management side, some carsharing services permit one-way trips, which allow the user to pick up the vehicle at one station, and return it to another. The flexibility offered by a one-way system makes it more attractive to users. However, it is harder to manage since it involves a possible imbalance between the demand and the availability of vehicles or, vice versa, between the number of vehicles in arrival and the availability of vacant parking lots, thereby making vehicle relocation necessary. In these cases, the service provider has to develop strategies to relocate the vehicles and restore an optimal distribution of the carsharing fleet. Such strategies also depend on the available data. Barth and Todd [4] propose the classification: *static relocation*, based on the immediate needs of a particular parking lot; *historical predictive relocation*, based on an estimation of the requests made using either the historical data of the service or travel demand estimation techniques; *exact predictive relocation*, based on a known demand (as is the case for a carsharing service which uses a system with reservations).

Vehicle relocation can be carried out by either the user or the service provider [5]. In the first case, the user is motivated to carpool or to choose another parking station or reservation time (generally through the pricing lever); in the second case, the vehicles are either transported on trucks or driven by the service provider staff.

However, in general, operating with EVs rather than traditional internal combustion engine cars further complicates the management of these systems, as shown in [6]. In particular, the authors consider several problems related to EV management (e.g. the poor battery range) from an optimization point of view. Hafez et al. [7] minimize the total travel time for relocation, using three different heuristics. Jung et al. [8] address the problem of locating infrastructures for EVs (i.e. electric taxis in their case) by proposing a new model in which the passenger demand is not known *a-priori*, thereby leading to a stochastic dynamic itinerary for each EV.

Kek et al. [9] design a system based on a three-step optimization-trend-simulation for supporting carsharing operators in relocating the vehicles. Such a system is tested considering the realistic scenario of a carsharing company in Singapore. Di Febbraro et al. [10] model the complex dynamics of the carsharing system, using a discrete event system simulation. The paper considers relocation by both users and staff, and has a twofold objective: to reduce the number of staff required and to minimize the number of carsharing vehicles needed in order to satisfy the system demand. Correia et al. [11] study the flexibility of one-way carsharing systems and propose a new mathematical formulation including the possibility for users to select the station according to its vehicle availability and not only depending on the distance from their origin/destination. A real life case study, concerning a carsharing system in Lisbon, is taken into account during the experimental campaign.

Very recent studies are reported in the work by Nourinejad and Roorda [12] in which the authors propose both an *a priori* benchmark model and a dynamic vehicle relocation optimization model. The latter is solved via a discrete-event simulator where the arrival of a user request constitutes an event. The numerical results discussed have shown that the optimization–simulation based model is suitable to determine a trade-off between the vehicle relocation time and the fleet size.

For the EV relocation problem, Bruglieri et al. [13], propose the use of a team of workers who can move easily and in an eco-sustainable way from a delivery point to a pick-up

point by means of a folding bicycle that can be loaded into the trunk of the EV which needs to be moved. Such a new relocation approach generates a challenging pick-up and delivery problem with features that have never been considered in the literature. We refer to this problem as the Electric Vehicle Relocation Problem (E-VReP). E-VReP shares some features with the 1-skip vehicle routing problem [14] and with the rollon–rolloff problem [15]. In particular, in all three problems, only one item at a time is assumed to be picked up and delivered. Moreover, the routes have to start from and end in a single depot without exceeding a given maximum time duration.

However, E-VReP is even more challenging than the above mentioned problems since the distance covered by a vehicle also depends on the EV picked up, i.e. its residual electrical charge. In [13], a Mixed Integer Linear Programming (MILP) formulation of the E-VReP is provided together with some techniques to speed up its solution.

We remark that in the E-VReP the set of delivery and pick-up requests is assumed to be known in advance and is therefore considered as the input of the problem. This assumption is realistic because, in the case of a carsharing system based on reservations, it is possible to know *a priori* the real needs of EV relocation according to the fleet size, the parking station size and the reserved carsharing demand. On the contrary (i.e. without reservations), the demand can be forecasted using different models and techniques proposed in the literature and mainly derived from studies in Logistics. For example, Cucu et al. [1] study a forecasting model to exploit customers' preferences so as to anticipate their needs and relocate the vehicles accordingly. Wang et al. [16] propose an aggregated model at station level for forecasting the total number of vehicles rented out and returned over time at each station.

In [17], realistic instances of the E-VReP are created through a simulator applied to some data provided by the Milan transport agency AMAT and by the main energy supplier company in Milan, A2A (www.a2a.eu).

In [29], Bruglieri et al. want to investigate the previously neglected aspect of the economic sustainability of the EV relocation approach. This is important in order to understand the practicability of the E-VReP, especially from the carsharing managers' point of view. To deal with economic sustainability, they introduce the costs related to the use of the workers and a revenue associated with each relocation request satisfied.

While their original problem [13] aims to handle as many requests as possible (neglecting the worker costs), the purpose of [29], is to maximize the total profit.

The aim of our paper is a little bit different from that of Bruglieri et al. [29] since we are trying to introduce two new features:

- The implementation of a working day with two work shifts:

  This new feature introduces two work shifts in each day, for example the morning and the afternoon. The first shift begins at t_0', and the second one at $t_0'' = t_0' + T$. Where T is the duration of the shift.

- The possibility of collaboration among operators, doing carpooling:

  It is known that in the original problem, operators have to bike for lots of kilometers. This supposes a problem since the average speed of a bike is much lower than the average speed of an EV. This new feature allows operators to collaborate. This means that an operator that have to reach a position in bike (to pick up an EV), can use the trip of another operator who is reaching the same zone with an EV (to deliver the EV). The result of this new feature is an augmentation of the operator's average speed, since some bike arcs are travelled in car too.

3. Statement and complexity of the E-VReP

Hereafter, in this paper, we apply the same description and notation already used in literature for the E-VReP. A one-way carsharing service with a homogeneous fleet of EVs is considered. Let *L* be the maximum distance that an EV can cover when its battery is fully charged. Such a distance depends on the kind of EV considered (in the experimental campaign we assume that *L* = 150 km). When the battery of an EV is not fully charged, the maximum distance that can be covered is assumed to be linearly proportional to the residual charge of the battery (i.e. an EV with a residual charge of 50% can cover *L/2* km). Concerning the recharge time of a battery, the question is slightly different since typically the recharge process comprises two phases: the first one is intensity-constant, the second one is tension-constant. The first phase allows to recharge the battery almost fully and it is linear on the time. The second phase is not linear on the time and can require some hours to achieve the full charge of the battery and to ensure an uninform recharge of all the cells that compose the battery. For sake of simplicity we do not consider the second phase of recharging to model the E-VReP as, e.g., in [19]. The maximum time needed to complete the first phase depends on the recharge technology used [18] and can vary for instance from Γ = 1 hour for a 380V Superfast Recharger to Γ = 5 hours for a 220V Multifast Recharger (in the experimental campaign we consider Γ = 4 hours). We suppose that each EV is always picked up and returned to a parking station equipped with a charging dock, so it can be recharged when it is not in use. Since in a one-way carsharing service the cars can be returned to parking stations which are different from the pick-up point, some vehicles need to be moved in order to prevent a station from running out of either EVs or parking lots.

Let *D* be the set of delivery requests (i.e. the requests to deliver EVs in order to prevent a station from running out of EVs) and let *P* be the set of pick-up requests (i.e. requests for EVs that need to be moved to vacant parking lots). Each relocation request $r \in P \cup D$ is characterized by a parking location v_r, i.e. a node of the road network, by the residual charge of the battery ρ_r and by a time window $[\tau_r^{min}, \tau_r^{max}]$ where τ_r^{min} and τ_r^{max} represent, respectively the earliest time and the latest time allowed to carry out the request *r*. For example, if *r* is a pick-up request then τ_r^{min} is the time prior to which the EV is not available while τ_r^{max} is the time after which picking up the EV is not convenient

(since from τ_r^{max} the EV may be used by another customer). For a delivery request *r*, ρ_r indicates the minimum charge level that the EV battery must have at time τ_r^{max}. Therefore, if an EV is delivered before τ_r^{max}, the charge level of its battery may be less than ρ_r. This is allowed provided that at least ρ_r is achieved at τ_r^{max}, considering that the battery is recharged after delivery. Whereas for a pick-up request *r*, ρ_r indicates the battery charge level at τ_r^{min}. Since the fleet of EVs is homogeneous each delivery request can be satisfied by picking up each EV of a pick-up request provided that it is compatible with the time windows and the battery charge level. Given a team of *K* workers who leave a single depot, even at different times, using folding bicycles, we aim to determine their routes and schedules so as to maximize the number of requests satisfied. Each route consists of an alternating sequence of pick-up and delivery requests, so that its duration does not exceed a given threshold *T* (i.e. the shifts of the workers), it ends at the depot and both the time windows and the battery charge level constraints are respected. This is the original statement of the E-VReP.

To deal with the economic sustainability of the E-VReP, we change the objective assuming that a revenue rev_i is associated with each relocation request *i* satisfied and a cost *C* is associated with each worker used. Thus, the E-VReP objective is modified into the maximization of the total profit given by the difference between the total revenue, represented by the sum of the revenues deriving from all the relocation requests satisfied, and the total cost, obtained by multiplying by *C* the number of the workers used in the fixed time horizon. The recharging cost is not considered directly because it is assumed to be fixed. In fact, carsharing companies usually pay the electric energy providers a fixed monthly rate which is proportional to the size of the fleet (this being a measure of the electricity consumption). Moreover, with this new objective, we obtain an extension of the original E-VReP since the previous objective can be obtained again by setting $C = 0$ and $rev_i = 1$ for each relocation request $i \in P \cup D$. All the input parameters used by the E-VReP are summarized in Table 1.

Symbol	Meaning
P	Pick-up set
D	Delivery set
$R = P \cup D$	Set of requests (either pick-up or delivery)
v_r	Parking location of request *r*
$[\tau_r^{min}, \tau_r^{max}]$	Time windows of request *r*
ρ_r	Battery level required for request *r*
rev_r	Revenue of request *r*
d_{ij}	Length of the shortest path from v_i to v_j
s'	Average speed of an EV
s''	Average speed of a bike
q'	Average time for parking an EV and taking the bike out of the EV trunk
q''	Average time for unloading the bike from de EV trunk and leaving the parking lot with the EV
Γ	Time needed for full battery recharging
L	Maximum distance traveled by a fully charged EV
0	Depot
K	Number of available workers
T	Shift of each worker
C	Worker cost

Table 1: Input parameters of the E-VReP.

4. Mathematical programming formulation

The formulation of the E-VReP is based on a directed graph $G=(N,A)$ that models all the possible actions rather than considering straightly the road network. The set of nodes of G is given by $N = P \cup D \cup \{0\}$ where 0 indicates the depot node. The set of arcs can be partitioned into two sets: the EV arcs and the bike arcs. The EV arcs model the action of a worker when he is traveling using an EV from a pickup point to a delivery point; the bike arcs model the action of a worker when he is traveling using a bike from a delivery point or from the depot to a pickup point or to the depot. Therefore, for each $i \in P$ and for each $j \in D$, the EV arcs link i and j through the ordered pairs (i, j), while the bike arcs are defined by the ordered pairs (j,i). Moreover, the bike arcs also include the arcs $(0, i)\ \forall i \in P$ and the arcs $(j, 0)\ \forall j \in D$.

For each $i \in P$ and for each $j \in D$, let d_{ij} denote the length of the shortest path from v_i to v_j with an EV, let d_{ji} denote the length of the shortest path from v_j to v_i with a bike, let s' indicate the average speed of an EV, let s'' indicate the average speed by bicycle of a worker, let q' be the time to park the EV and take the bike from the EV trunk, let q'' be the time to load the bike in the EV trunk and leave the parking lot with the EV. We associate an operational time c_{ij} with every kind of arc as reported in Table 2.

Arcs	Operational times	Involved nodes
(*i*, *j*)	$d_{ij} / s' + q' + q''$	$\forall i \in P, \forall j \in D: \tau_j^{max} \geq \tau_i^{min} + d_{ij} / s' + q' + q''\ ;\ d_{ij} \leq L$
(*j*, *i*)	d_{ij} / s''	$\forall i \in P, \forall j \in D: \tau_i^{max} \geq \tau_j^{min} + d_{ji} / s''$
(0,*i*)	d_{0i} / s''	$\forall i \in P$
(*j*,0)	d_{j0} / s''	$\forall j \in D$

Table 2: Operational times of the arcs of graph.

There are two main advantages to deal with the graph G rather than directly with the road network. The first one is that an elementary cycle on graph G corresponds always to every feasible route of a worker, whereas this is not true in the original road network when there are multiple requests in the same parking and modeling nonelementary cycles is by far harder [32]. The second advantage, even in the case of a single request for each parking, is that a formulation based on graph G requires by far less variables than a formulation based on the

road network, because variables are defined on the arcs and nodes of the used graph. The dimension of graph *G* depends only on the number of requests (since $|N|=|P|+|D|+1$ and $|A|=2|P||D|+|P|+|D|$) and not by the number of the physical nodes (road intersections) and road links. For instance, the Milan road network considered contains more than 23,000 road links, which are by far greater than $|A|$ even for a high number of EVs to be redistributed.

Let us introduce the binary routing variables y_{ij} equal to 1 if a worker visits node $j \in N$ immediately after node $i \in N$, 0 otherwise. Let us also introduce the integer variable x_{ij} to model the number of operators travelling (for example carpooling) the arc (i, j). And let us also introduce the continuous variable t_i to model the arrival time to the parking v_i of the worker in charge of that request. The last introduced variable is the binary ε_i equal to 1 if the request i is served in the second shift, 0 if served in the first one. We state that the E-VReP can be modeled by way of the following MILP (note that for all $i \in N$, we indicate with $\delta^+(i)$ and $\delta^-(i)$ the forward star and the backward star of node i, respectively.

The mathematical program is as follows:

$$[MAX]f = \sum_{(i,j)\in A | i\in P, j\in D} \left(rev_i + rev_j\right) \cdot y_{ij} - \sum_{j\in\delta^+(0)} C \cdot x_{0j} - 10^{-4} \cdot \sum_{i\in P\cup D} (t_i - \tau_i^{min})$$

subject to:

$$\sum_{j\in\delta^+(0)} x_{0j} \leq K \tag{2}$$

$$\sum_{j\in\delta^+(i)} y_{ij} \leq 1 \quad \forall i \in P \tag{3}$$

$$\sum_{j\in\delta^-(j)} y_{ij} \leq 1 \quad \forall j \in D \tag{4}$$

$$\sum_{j\in\delta^+(i)} x_{ij} - \sum_{j\in\delta^-(i)} x_{ji} = 0 \quad \forall i \in P \cup D \cup \{0\}$$

(5)

$$t_i + C_{ij}\cdot y_{ij} \le t_j + M\cdot\left(1 - y_{ij}\right) \quad \forall (i,j) \in A, i \neq 0, j \neq 0$$

(6)

$$t_i + C_{i0}\cdot y_{i0} - t_0'\cdot(1-\varepsilon_i) - t_0''\cdot\varepsilon_i \le T \quad \forall i \in \delta^-(0)$$

(7)

$$t_j \ge t_0'\cdot\left(1-\varepsilon_j\right) + t_0''\cdot\varepsilon_j + C_{0j}\cdot y_{0j} \quad \forall j \in \delta^+(0)$$

(8)

$$\tau_i^{min} \le t_i \le \tau_i^{max} \quad \forall i \in P \cup D$$

(9)

$$d_{ij}\cdot y_{ij} \le L\cdot\left(\rho_i + \frac{t_i - \tau_i^{min}}{\Gamma}\right) \quad \forall (i,j) \in A | i \in P, j \in D$$

(10)

$$\rho_i + \frac{t_i - \tau_i^{min}}{\Gamma} - \frac{d_{ij}}{L}\cdot y_{ij} \ge \rho_j - \frac{\tau_j^{max} - t_j}{\Gamma} - \left(\rho_j + 1\right)\cdot\left(1 - y_{ij}\right) \quad \forall (i,j) \in A | i \in P, j \in D$$

(11)

$$1 - \frac{d_{ij}}{L}\cdot y_{ij} \ge \rho_j - \frac{\tau_j^{max} - t_j}{\Gamma} - (\rho_j + 1)\cdot\left(1 - y_{ij}\right) \quad \forall (i,j) \in A | i \in P, j \in D$$

(12)

$$x_{ij} \le \tilde{C}\cdot y_{ij} \quad \forall (i,j) \in A$$

(13)

$$y_{ij} \leq x_{ij} \quad \forall (i,j) \in A$$

(14)

$$\begin{cases} \varepsilon_i - \varepsilon_j \leq 1 - y_{ij} \\ \varepsilon_j - \varepsilon_i \leq 1 - y_{ij} \end{cases} \quad \forall (i,j) \in A, i \neq 0, j \neq 0$$

(15)

where:

$$x_{ij} \geq 0 \text{ integer} \quad \forall (i,j) \in A$$

(16)

$$y_{ij} \in \{0,1\} \quad \forall (i,j) \in A$$

(17)

$$\varepsilon_i \in \{0,1\} \quad \forall i \in P \cup D$$

(18)

$$t_i \geq 0 \quad \forall i \in P \cup D$$

(19)

Since each arc connects a pair of requests, the objective function (1) almost represents the total benefit of the service. The first two terms of the sum represent the total benefit (total revenues – total costs), while the third term ensures that operators serve the requests as soon as possible. Constraints (2) take into account that at most K workers are available, and therefore, at most K routes can be generated imposing that at most one arc for each worker can leave the depot node 0 (because they leave the depot by bike). Constraints (3) and (4) impose that each request is satisfied at most once. Flow conservation constraints (5) ensure that the solution is a collection of cycles. Constraints (6) rule the time variables ensuring that the visit time of a node is given by the sum of the visit time of its predecessor and the operational time to go from the predecessor to the current node. Note that such constraints are not imposed for the depot node to ensure that the route can pass through the depot and at the same time they prevent the solution

from containing isolated cycles that do not pass through the depot. In this way, the formulation does not require additional subtour elimination constraints. Constraints (7) ensure that the duration of each route does not exceed the threshold *T*. Constraints (8) take into account that an operator can begin to work at t_0' or at t_0''. Constraints (9) enforce the time windows for the pickup and delivery requests. Constraints (10) model the fact that the maximum distance traveled by an EV is linearly proportional to the residual charge. Note that if $\rho_i + \frac{t_i - \tau_i^{min}}{\Gamma} > 1$, such constraints become redundant since the graph topology prevent already the existence of arcs *(i , j)* with $d_{ij} > L$. Constraints (11) and (12) ensure that an EV is delivered with a battery level such that at the time τ_j^{max} a charge level not lower than ρ_j will be achieved. Constraints (13) limits de capacity of an EV (maximum number of operators carpooling in the same car). Constraints (14) relate the routing variables. And finally, constraints (15) assures that an operator only works in one shift (only in the morning, or only in the afternoon).

5. Speedup techniques for the MILP formulation

In this section, we present some techniques to speed up the solution of MILP formulation (1)–(19) of the E-VReP when a commercial MILP solver (e.g., Gurobi) is used.

The first technique consists in reducing the number of arcs considered in the graph representation, by excluding the arcs that cannot model feasible actions. In particular, the EV arcs (*i, j*) are defined not for every pair of node $i \in P$ and $j \in D$ but only for the ones that satisfy the following four conditions:

$$\frac{d_{0i}}{s''} + \frac{d_{ij}}{s'} + \frac{d_{j0}}{s''} \leq T \tag{20}$$

$$\tau_j^{min} - \tau_i^{max} + \frac{d_{0i}}{s''} + \frac{d_{j0}}{s''} \leq T \tag{21}$$

$$d_{ij} \leq L \cdot min\left\{1, \rho_i + \frac{\tau_i^{max} - \tau_i^{min}}{\Gamma}\right\} \tag{22}$$

$$\max\left\{\Gamma \cdot \left(\frac{d_{ij}}{L} + \rho_j - \rho_i\right), 0\right\} + \frac{d_{ij}}{s'} \leq \tau_j^{max} - \tau_i^{min} \tag{23}$$

Condition (20) takes into account the time to travel -within the working time *T*- from the depot to v_i, from v_i to v_j and then to the depot. Condition (21) is necessary to respect both the request time windows and the working time when a worker needs to wait to serve request *j*. Condition (22) ensures that even if the EV is picked up as later as possible (i.e., at τ_i^{max}), the battery level achieved is sufficient to cover the trip from v_i to v_j along the shortest path. Condition (23) checks if the time necessary to reach the battery level of the delivery request -starting from the battery charge level of the pickup request ($\Gamma\,(\rho_j - \rho_i)$)- is compatible with the time windows of both the requests, taking into account also the battery consumption ($\Gamma\, d_{ij} / L$) and the time (d_{ij} / s') used to travel from v_i to v_j.

In a similar way, the bike arcs (*j* , *i*) are defined for each *j* ∈ *D* and for each *i* ∈ *P* such that the following condition holds:

$$\tau_i^{max} \geq \tau_j^{min} + \frac{d_{ji}}{s''} \tag{24}$$

We call A2, the set of arcs that satisfy conditions (20)-(24).

6. Estimation of the relocation requests

Considering the classification reported in the introduction, we are in the case of the historical predictive relocation [4], where the objective is to estimate what will be the deficiency or excess of vehicles at each station. We estimated the electric car-sharing demand, exploiting the survey on the mobility of people in the Milan area, carried out by the Agency for Mobility, Environment and Territory of the Municipality of Milan [26]. The data concerns the private car movements and are represented by the Origin-Destination (O- D) matrix from/to different zones of Milano, with movements having different aims (business, study, occasional trips, etc) and in different time-slots of the day: morning (7:00 to 10:00), not-peak (10:00 to 16:00) and evening (16:00 to 20:00). We used the data regarding the "occasional trip" aim.

As regards the car sharing parking stations, we used the current charging infrastructure: the electric charging slots installed in the municipal area from A2A, the main energy supplier company in Milan, within the project E- Moving [27]. Figure 3 depicts the location of such stations (5 stations with 4 slots and 21 with 2 slots), and in red the delimitation of the zoning used for the O-D matrix.

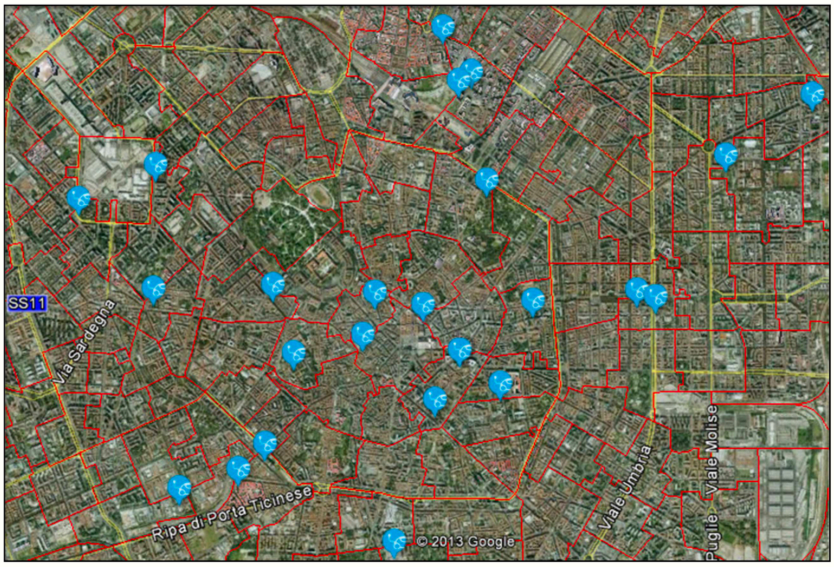

Figure 3: Charging stations used for the numerical experiments.
In red, the delimitation of the zoning used for the O-D matrix.

We intersected the O-D zones with a circular boundary of 500 meters around each charging station, which represent the area easily reached on foot by the station. The intersection let us

estimate the potential number of movements that could be carried out with the car sharing service, instead of the private car. Then, we multiplied such values by 0.5%, to consider that only a percentage of the potential demand will end using the service. Such value is consistent with the present usage of the Milano car sharing service.

In order to estimate the requests of the relocation staff, we estimated the unbalances due to the projected travel demand. A car sharing simulator has been developed [17] in MATLAB to emulate the operational logic of the electric car sharing service. We feed the time-stepping simulator with the operational data of the stations (e.g. station capacities), travel time between stations, and travel demand. At every simulated minute, the simulator updates the inventory of each station and both position and charge level of the vehicles. If in the simulation a station *s* runs out of EVs and a user asks for an EV then a delivery requests *r* for the E-VReP is generated with v_r equal to the node of the road network corresponding to *s*, τ_r^{min} equal to the minute when such an event happens, τ_r^{max} equal to the earliest minute when an EV arrives to *s* (or $\tau_i^{max} = \infty$ if the latter event never happens) and ρ_r is a random level of charge such that the user can reach its destination. In similar way a pickup request for the E-VReP is generated when in the simulation a parking station is full and a user wants to return an EV in such a station.

7. Experimental campaign

Considering a fleet of 30 EVs initially distributed in random way, we have built 30 instances of the E-VReP running 30 times the car sharing simulator described in the previous section. In such instances the number of pickup requests often differ from the number of delivery requests making impossible to serve all the requests through the relocation method of the E-VReP since every tour of a worker needs to alternate a pickup request with a delivery request. The maximum number of requests that may be served through the E-VReP is given by:

$$Max_{Served} = 2 \cdot \min \{|P|, |D|\}$$

Concerning these 30 instances, in this scenario, the worker cost is evaluated multiplying the number of routes by the unit of labor cost, i.e. 60€. The cost per worker is derived by considering a cost of 12€/h (as in [28]), and that each operator is employed for a work shift of 5h. Moreover, the parameter rev_r (i.e. the revenue associated with the generic request *r* satisfied) has been set at 20€ as the *penalty cost* for lost customers indicated in the above cited paper. The main input data values used for the MILP formulation of the E-VReP mentioned in Section 3 are summarized in Table 4.

Input Data	T	s'	s''	q'	q''	L	Γ	C
Values	300 min	25 km/h	15 km/h	1 min	1 min	150 km	240 min	60€

Table 4: Main input data values for the E-VReP used in experiments

The MILP formulation has been implemented in AMPL (see annex 1) and solved (see annex 2) with the state of the art solver Gurobi 7.5.1 on a PC Intel Core i5 2GHz with 8GB RAM. A CPU time limit of 3600 seconds has been imposed. The numerical results on the 30 instances (see annexes 3 to 33) of the E-VReP with 1 and 2 shifts, and with and without carpooling are reported in Table 5.

The columns indicate respectively the instance name, the number of requests (both pick-up and delivery requests: $|P| \cup |D|$), the maximum number of requests that can be satisfied, and then, for each case (with 1 or 2 shifts, and with or without carpooling) the number of requests served, the number K of workers used, and the total benefit B.

Instance			1 shift without carpooling			1 shift with carpooling			2 shifts without carpooling			2 shifts with carpooling		
AMAT	|PUD|	Max R.	Nº Req serv	K	B	Nº Req serv	K	B	Nº Req serv	K	B	Nº Req serv	K	B
1	27	24	20	1	340	20	1	340	24	2	360	24	2	360
2	22	14	14	1	220	14	1	220	14	1	220	14	1	220
3	22	12	12	1	180	12	1	180	12	1	180	12	1	180
4	29	28	22	1	380	22	1	380	22	1	380	22	1	380
5	24	22	20	1	340	20	1	340	20	1	340	20	1	340
6	15	14	12	1	180	12	1	180	12	1	180	12	1	180
7	17	16	14	1	220	14	1	220	14	1	220	14	1	220
8	21	20	14	1	220	14	1	220	18	2	240	18	2	240
9	22	14	14	1	220	14	1	220	14	1	220	14	1	220
10	22	22	12	1	180	12	1	180	20	2	280	20	2	280
11	18	16	16	1	260	16	1	260	16	1	260	16	1	260
12	18	12	12	1	180	12	1	180	12	1	180	12	1	180
13	25	24	18	1	300	18	1	300	22	2	320	22	2	320
14	18	12	12	1	180	12	1	180	12	1	180	12	1	180
15	16	10	10	1	140	10	1	140	10	1	140	10	1	140
16	27	22	20	1	340	20	1	340	20	1	340	20	1	340
17	31	30	22	1	380	22	1	380	28	2	440	28	2	440
18	22	20	14	1	220	14	1	220	14	1	220	14	1	220
19	22	14	14	1	220	14	1	220	14	1	220	14	1	220
20	25	16	16	1	260	16	1	260	16	1	260	16	1	260
21	28	24	20	1	340	20	1	340	20	1	340	20	1	340
22	21	16	14	1	220	14	1	220	14	1	220	14	1	220
23	18	18	14	1	220	14	1	220	14	1	220	14	1	220
24	19	14	14	1	220	14	1	220	14	1	220	14	1	220
25	16	14	10	1	140	10	1	140	14	2	160	14	2	160
26	22	22	20	1	340	20	1	340	20	1	340	20	1	340
27	26	24	22	1	380	22	1	380	22	1	380	22	1	380
28	24	22	16	1	260	16	1	260	16	1	260	16	1	260
29	23	20	16	1	260	16	1	260	20	2	280	20	2	280
30	24	18	16	1	260	16	1	260	16	1	260	16	1	260

Table 5: Numerical results for the E-VReP formulation on AMAT data

Conclusions

In previous works, Bruglieri et al. have introduced the E-VReP and its resolution through a mathematical program. First, the objective was to maximize the total number of served requests. Then, they introduced the economic sustainability of the relocation, trying to maximize the total benefit of the company. Even if the objective has not ever been the same, the features of the problem have never changed: an operator leaves de depot driving a folding bike, alternates routes in bike, in car, in bike, in car, etc. and comes back to the depot in bike.

In this new work, authors want to add two new features to the E-VReP. The first one is the implementation of a working day with two work shifts. Until now each operator could start working at different times. With this new feature, we set two shifts each day, one in the morning, and one in the afternoon. The second novelty is the possibility for operators to collaborate among them. This means that operators can carpool in an EV in order to reach their destinations faster than if they tried reaching it by bike.

After running our mathematical model with the 30 real instances created by MATLAB, we can observe the effects of these two new features.

Regarding the implementation of the working day with two shifts, in 7 out of 30 instances the second shift is useful to maximize the company's benefits, whereas in 23 out of 30 instances, the first shift is enough to arrive to the optimal solution.

Concerning the possibility for operators to collaborate among them, the results with these instances, show that this collaboration is not useful to maximize the company's benefits. In fact, the results with collaboration among operators are exactly the same that without this collaboration. It must be said that in several cases the CPU time limit is reached, and therefore no one can claim that in the optimal solution carpooling is not used.

In conclusion, we can affirm that the implementation of the working day with two shifts can be interesting in some cases. Instead, the implementation of the collaboration among operators seem to be not useful in these kind of real instances.

Even the results on these real instances, authors have found some cases where the collaboration among operators can be useful to maximize the total benefit. Future works may investigate in which cases can be interesting for the operators to collaborate among them.

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References

[1] T. Cucu, L. Ion, Y. Ducq, J.-M. Boussier, Management of a public transportation service: Carsharing service, in: Proceedings of The 6th International Conference on Theory and Practice in Performance Measurement and Management, 2009.

[2] G.H.A. Correia, A.P. Antunes, Optimization approach to depot location and trip selection in one-way carsharing systems, Transp. Res. Part E: Logist. Transp. Rev. 48 (2012) 233–247.

[3] D. Jorge, G.H.A. Correia, Carsharing systems demand estimation and defined operations: a literature review, Eur. J. Transp. Infrastruct. Res. 13 (2013) 201–220.

[4] M. Barth, M. Todd, Simulation model performance analysis of a multiple station shared vehicle system, Transp. Res. C 7 (4) (1999) 237–259.

[5] M. Barth, M. Todd, L. Xue, User-based vehicle relocation techniques for multiple-station shared-use vehicle systems, Transp. Res. Rec. 1887 (2004) 137–144.

[6] N. Touati-Moungla, V. Jost, Combinatorial optimization for electric vehicles management, J. Energy Power Eng. 6 (5) (2012) 738–743.

[7] N. Hafez, M. Parent, J.M. Proth, Managing a pool of self service cars, in: Intelligent Transportation Systems. Proceedings. 2001 IEEE, IEEE, 2011, pp. 943–948.

[8] J. Jung, J.Y. Chow, R. Jayakrishnan, J.Y. Park, Stochastic dynamic itinerary interception refueling location problem with queue delay for electric taxi charging stations, Transp. Res. C 40 (2014) 123–142.

[9] A.G. Kek, R.L. Cheu, Q. Meng, C.H. Fung, A decision support system for vehicle relocation operations in carsharing systems, Transp. Res. Part E: Logist. Transp. Rev. 45 (1) (2009) 149–158.

[10] A. Di Febbraro, N. Sacco, M. Saeednia, One-way carsharing: Solving the relocation problem, in: Transportation Research Board 91st Annual Meeting, 2012.

[11] G.H.A. Correia, D.R. Jorge, D.M. Antunes, The added value of accounting for users' flexibility and information on the potential of a station-based one-way car-sharing system: An application in Lisbon, Portugal, J. Intell. Transp. Syst.: Technol. Plann. Oper. 18 (3) (2014) 299–308.

[12] M. Nourinejad, M.J. Roorda, A dynamic carsharing decision support system, Transp. Res. E 66 (2014) 36–50.

[13] M. Bruglieri, A. Colorni, A. Lu`e, The vehicle relocation problem for the one-way electric vehicle sharing, Networks 64 (4) (2014) 292–305.

[14] C. Archetti, M. Speranza, Vehicle routing in the 1-skip collection problem, J. Oper. Res. Soc. 55 (7) (2004) 717–727.

[15] R. Aringhieri, M. Bruglieri, F. Malucelli, M. Nonato, An asymmetric vehicle routing problem arising in the collection and disposal of special waste, Electron. Notes Discrete Math. 17 (2004) 41–47.

[16] H. Wang, R. Cheu, D.H. Lee, Logistical inventory approach in forecasting and relocating share-use vehicles, in: 2010 2nd International Conference on Advanced Computer Control, ICACC, Vol. 5, 2010, pp. 314–318.

[17] M. Bruglieri, A. Colorni, A. Luè, The vehicle relocation problem for the one-way electric vehicle sharing: an application to the Milan case, Procedia Soc. Behav. Sci. 111 (2014) 18–27.

[18] F. Marra, G.Y. Yang, C. Træholt, E. Larsen, C.N. Rasmussen, S. You, Demand profile study of battery electric vehicle under different charging options. in: Power and Energy Society General Meeting, 2012 IEEE, 2012, pp. 1–7.

[19] M. Schneider, A. Stenger, D. Goeke, The electric vehicle routing problem with time windows and recharging stations, Transp. Sci. (2014) 500–520. Published on-line in Articles in Advance 06.

[20] D. Feillet, P. Dejax, M. Gendreau, Traveling salesman problems with profits, Transp. Sci. 39 (2) (2005) 188–205.

[21] A. Blum, S. Chawla, D.R. Karger, T. Lane, A. Meyerson, M. Minkoff, Approximation algorithms for orienteering and discounted-reward TSP, SIAM J. Comput. 37 (2) (2007) 653–670.

[22] G. Schrimpf, K. Schneider, H. Stamm-Wilbrandt, V. Dueck, Record breaking optimization results using the ruin and recreate principle, J. Comput. Phys. 159 (2000) 139–171.

[23] E. Aarts, J.K. Lenstra (Eds.), Local Search in Combinatorial Optimization, John Wiley & Sons, Chichester, UK, 1997.

[24] P. Toth, D. Vigo, Vehicle Routing, Society for Industrial and Applied Mathematics, Philadelphia, PA, 2014.

[25] R. Fourer, D. Gay, B.W. Kernighan, The Ampl Book, Duxbury Press, Pacific Grove, 2002.

[26] AMAT. Dati sul traffico veicolare privato sulla rete stradale di Milano – (Origin Destination Matrix, in Italian), 2005. Available at http://www.amat-mi.it/it/downloads/8/.

[27] A2A. Progetto E-Moving (in Italian), 2013. Available at http://www.e-moving.it/home/cms/emv/.

[28] B. Boyacı, K. Zografos, N. Geroliminis, An optimization framework for the development of efficient one-way car sharing systems, European J. Oper. Res. 240 (3) (2015) 718–733.

[29] M. Bruglieri, F. Pezzella, O. Pisacane, Heuristic algorithms for the operator-based relocation problema in one-way electric carsharing systems, ELSEVIER. Discrete Optimization 23 (2017) 56–80.

[30] Harms, S., & Truffer, B. (1998). The emergence of a nationwide car sharing co-operative in Switzerland. Report for the EAWAG (Eidgenossische Anstalt für Wasserversorgung, Abwasserreinigung und Gewässerschutz), Dübendorf.

[31] Du, Y, & Hall, R. (1997). Fleet Sizing And Empty Equipment Redistribution for Center-Terminal Transportation Networks. *Management Science,* 43, 145-157.

[32] Dror, M., Fortin, D., & Roucariol, C. (1998). Redistribution of self-service electric cars: a case of pickup and delivery. *Rapport of research n. 3543*, INRIA.

Annexes

Annex 1: File .mod

```
param dep, default 3291;

set V;

set PARKING;

set PKUP;

set DVRY;

set N:= PKUP union DVRY union {dep};

param K>=1, default 4;

param cap>=1, default 4;

param cost >=0, default 60;

param tprima >=0, default 480;

param tseconda >=0 default 780;

param dist{i in PARKING, j in PARKING}, default 1000000;

param rev{PKUP union DVRY};

param R{PKUP union DVRY};

param P{PKUP union DVRY} symbolic in PARKING;

param TAU_MIN{PKUP union DVRY};

param TAU_MAX{PKUP union DVRY};

param T;

param s1>=0, default 0.416666667;

param s2>=0, default 0.250;

param q1>=0, default 1;

param q2>=0, default 1;

param GAMMA >=0, default 240;

param L >=0, default 150;
```

```
set A2:={i in PKUP, j in DVRY: P[i]!=P[j]
and dist[P[i],P[j]]<=min(L,(R[i]+ (TAU_MAX[i]-TAU_MIN[i])/GAMMA )*L)
#and dist[dep,P[i]]/s2+(dist[P[j],dep]/s2)+(dist[P[i],P[j]]/s1)<=T
#and TAU_MIN[j]-TAU_MAX[i]+(dist[dep,P[i]]/s2)+(dist[P[j],dep]/s2)<=T
and max(0,(dist[P[i],P[j]]/L + R[j]-R[i])*GAMMA)+(dist[P[i],P[j]]/s1)
<= TAU_MAX[j] - TAU_MIN[i]}
union {j in DVRY, i in PKUP: P[i]!=P[j] and TAU_MAX[i]>= TAU_MIN[j]+
(dist[P[j],P[i]]/s2)}
union {j in DVRY, i in N: i=dep} union {i in N, j in PKUP: i=dep};

param c{A2} >=0, default 1000000;

var y{A2} binary;

var x{A2} integer >=0;

var xi{PKUP union DVRY} binary;

var t{PKUP union DVRY} >=0;

maximize obj:  sum{i in PKUP, j in DVRY: (i,j) in A2}
(rev[i]+rev[j])*y[i,j] - sum{(i,j) in A2: i=dep} cost*x[i,j] - sum{i
in PKUP union DVRY} 0.0001*(t[i]-TAU_MIN[i]);

# constr (2)
subject to workers_used: sum{(i,j) in A2: i=dep}x[i,j]<=K;

# constr (3)
subject to request_satisfaction{i in PKUP}: sum{j in DVRY: (i,j) in
A2} y[i,j]<=1;

# constr (4)
subject to request_satisfaction2{j in DVRY}: sum{i in PKUP: (i,j) in
A2} y[i,j]<=1;

# constr (5)
subject to flow{i in PKUP union DVRY union {dep}}: sum{j in PKUP union
DVRY union {dep}: (i,j) in A2} x[i,j]- sum{j in PKUP union DVRY union
{dep}: (j,i) in A2} x[j,i] =0;

# constr (6)
subject to time_increasing{(i,j) in A2: j!=dep and i!=dep}:
t[i]+c[i,j]*y[i,j]<= t[j]+1200*(1-y[i,j]);

# constr (7)
subject to max_worker_time{i in DVRY: (i,dep) in A2}:
t[i]+c[i,dep]*y[i,dep]-tseconda*xi[i]-tprima*(1-xi[i])<=T;

# constr (8)
subject to starting_time{j in PKUP: (dep,j) in A2}:
t[j]>=tseconda*xi[j]+tprima*(1-xi[j])+ c[dep,j]*y[dep,j];
```

```
# constr (9)
subject to time_windows_min{i in (PKUP union DVRY)}: t[i]>=TAU_MIN[i];

# constr (9bis)
subject to time_windows_max{i in (PKUP union DVRY)}: t[i]<=TAU_MAX[i];

# constr (10)
subject to max_covered_distance{i in PKUP, j in DVRY: (i,j) in A2}:
dist[P[i],P[j]]*y[i,j]<=L*(R[i] + ((t[i]-TAU_MIN[i])/GAMMA));

# constr (11)
subject to charge_level1{i in PKUP, j in DVRY: (i,j) in A2}: R[i] + (
(t[i]-TAU_MIN[i])/GAMMA) - ((dist[P[i],P[j]]*y[i,j])/L) >= R[j] -(
(TAU_MAX[j]-t[j])/GAMMA) -(R[j]+1)*(1-y[i,j]);

# constr (12)
subject to charge_level2{i in PKUP, j in DVRY: (i,j) in A2}: 1 -
((dist[P[i],P[j]] *y[i,j])/L) >= R[j] -( (TAU_MAX[j]-t[j] )/GAMMA)   -
(R[j]+1)*(1-y[i,j]);

# constr (13)
subject to variables1{(i,j) in A2}: x[i,j] <= cap*y[i,j];

# constr (14)
subject to variables2{(i,j) in A2}: y[i,j] <= x[i,j];

# constr (15)
subject to same_turno{(i,j) in A2: j!=dep and i!=dep}: xi[i]-xi[j]<=1-
y[i,j];


# constr (15bis)
subject to same_turno_2{(i,j) in A2: j!=dep and i!=dep}: xi[j]-
xi[i]<=1- y[i,j];
```

Annex 2: File .run

```
reset;

option solver gurobi;

model downloads/amplide.macosx64/models/carsharing.mod;

data downloads/amplide.macosx64/models/AMAT-SET/PRENOT_GG27.dat;

data downloads/amplide.macosx64/models/ReteAmat_new.dat;


for {i in PKUP, j in DVRY: (i,j) in A2} {
      let c[i,j]:= dist[P[i],P[j]]/s1+q1+q2;
}

for {i in DVRY, j in PKUP: (i,j) in A2} {
      let c[i,j]:= dist[P[i],P[j]]/s2;
}

for {(i,j) in A2: i=dep and j in PKUP} {
      let c[i,j]:= dist[i,P[j]]/s2;
}

for {(i,j) in A2: i in DVRY and j=dep} {
      let c[i,j]:= dist[P[i],j]/s2;
}

solve;

display y;

display x;

display t;

display xi;

display sum{i in PKUP, j in DVRY: (i,j) in A2 } 2*y[i,j];

display sum{(i,j) in A2: i=dep}x[i,j];

display sum{i in PKUP, j in DVRY: (i,j) in A2 } (rev[i]+rev[j])*y[i,j]
- sum{(i,j) in A2: i=dep} cost*x[i,j];

display _solve_elapsed_time;
```

Annex 3: File ReteAmat_new.dat

```
let dist[3178, 16030]:= 5.700830 ;
let dist[3178, 27104]:= 5.291070 ;
let dist[3178, 2118]:= 3.391640 ;
let dist[3178, 3291]:= 4.923410 ;
let dist[3178, 1581]:= 5.853390 ;
let dist[3178, 14400]:= 9.356150 ;
let dist[3178, 2613]:= 9.053810 ;
let dist[3178, 2341]:= 8.713810 ;
let dist[3178, 15410]:= 7.113890 ;
let dist[3178, 2490]:= 8.291580 ;
let dist[3178, 2078]:= 3.543810 ;
let dist[3178, 1583]:= 5.853390 ;
let dist[3178, 31232]:= 7.495990 ;
let dist[3178, 8425]:= 7.825990 ;
let dist[3178, 31121]:= 8.363810 ;
let dist[3178, 31277]:= 7.681580 ;
let dist[3178, 2159]:= 3.911640 ;
let dist[3178, 10737]:= 5.826410 ;
let dist[3178, 31098]:= 6.135990 ;
let dist[3178, 8529]:= 7.135990 ;
let dist[3178, 8142]:= 7.233810 ;
let dist[3178, 13665]:= 7.043810 ;
let dist[3178, 8586]:= 6.784720 ;
let dist[3178, 19118]:= 7.213810 ;
let dist[3178, 8602]:= 6.503810 ;
let dist[16030, 3178]:= 5.563430 ;
let dist[16030, 27104]:= 6.839650 ;
let dist[16030, 2118]:= 3.370000 ;
let dist[16030, 3291]:= 6.102680 ;
let dist[16030, 1581]:= 6.760000 ;
let dist[16030, 14400]:= 8.428420 ;
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let dist[16030, 2341]:= 7.178470 ;
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let dist[16030, 8142]:= 6.008420 ;
let dist[16030, 13665]:= 5.428420 ;
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let dist[16030, 8602]:= 5.850850 ;
let dist[27104, 3178]:= 5.162660 ;
let dist[27104, 16030]:= 6.850330 ;
```

```
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let dist[27104, 3291]:= 1.290000 ;
let dist[27104, 1581]:= 3.010000 ;
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let dist[27104, 31121]:= 7.410000 ;
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let dist[2118, 3291]:= 3.122750 ;
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let dist[2118, 2341]:= 5.540000 ;
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let dist[2118, 2490]:= 5.020000 ;
let dist[2118, 2078]:= 0.620000 ;
let dist[2118, 1583]:= 3.410000 ;
let dist[2118, 31232]:= 4.580420 ;
let dist[2118, 8425]:= 4.910420 ;
let dist[2118, 31121]:= 5.190000 ;
let dist[2118, 31277]:= 4.410000 ;
let dist[2118, 2159]:= 0.520000 ;
let dist[2118, 10737]:= 2.936110 ;
let dist[2118, 31098]:= 3.220420 ;
let dist[2118, 8529]:= 4.220420 ;
let dist[2118, 8142]:= 4.060000 ;
let dist[2118, 13665]:= 3.870000 ;
let dist[2118, 8586]:= 3.894420 ;
let dist[2118, 19118]:= 4.040000 ;
let dist[2118, 8602]:= 3.330000 ;
let dist[3291, 3178]:= 4.810940 ;
let dist[3291, 16030]:= 6.100030 ;
let dist[3291, 27104]:= 1.120000 ;
let dist[3291, 2118]:= 3.325000 ;
let dist[3291, 1581]:= 1.720000 ;
let dist[3291, 14400]:= 5.660100 ;
```

```
let dist[3291, 2613]:= 7.230000 ;
let dist[3291, 2341]:= 6.470000 ;
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let dist[8586, 27104]:= 4.897130 ;
let dist[8586, 2118]:= 3.270000 ;
let dist[8586, 3291]:= 3.977130 ;
let dist[8586, 1581]:= 3.240000 ;
let dist[8586, 14400]:= 5.430000 ;
let dist[8586, 2613]:= 4.850000 ;
let dist[8586, 2341]:= 4.510000 ;
let dist[8586, 15410]:= 4.430000 ;
let dist[8586, 2490]:= 5.000000 ;
let dist[8586, 2078]:= 2.970000 ;
let dist[8586, 1583]:= 3.170000 ;
let dist[8586, 31232]:= 3.530000 ;
let dist[8586, 8425]:= 3.860000 ;
let dist[8586, 31121]:= 4.160000 ;
let dist[8586, 31277]:= 4.000000 ;
```

```
let dist[8586, 2159]:= 2.900000 ;
let dist[8586, 10737]:= 2.486530 ;
let dist[8586, 31098]:= 2.170000 ;
let dist[8586, 8529]:= 3.170000 ;
let dist[8586, 8142]:= 3.030000 ;
let dist[8586, 13665]:= 2.840000 ;
let dist[8586, 19118]:= 3.010000 ;
let dist[8586, 8602]:= 2.300000 ;
let dist[19118, 3178]:= 7.716600 ;
let dist[19118, 16030]:= 6.264300 ;
let dist[19118, 27104]:= 6.667130 ;
let dist[19118, 2118]:= 4.409940 ;
let dist[19118, 3291]:= 5.732470 ;
let dist[19118, 1581]:= 4.192470 ;
let dist[19118, 14400]:= 2.971830 ;
let dist[19118, 2613]:= 2.740000 ;
let dist[19118, 2341]:= 2.180000 ;
let dist[19118, 15410]:= 2.560000 ;
let dist[19118, 2490]:= 3.130000 ;
let dist[19118, 2078]:= 4.609825 ;
let dist[19118, 1583]:= 4.122470 ;
let dist[19118, 31232]:= 2.452470 ;
let dist[19118, 8425]:= 2.132470 ;
let dist[19118, 31121]:= 1.830000 ;
let dist[19118, 31277]:= 2.130000 ;
let dist[19118, 2159]:= 4.439825 ;
let dist[19118, 10737]:= 4.256530 ;
let dist[19118, 31098]:= 3.122470 ;
let dist[19118, 8529]:= 2.852470 ;
let dist[19118, 8142]:= 0.920000 ;
let dist[19118, 13665]:= 1.090000 ;
let dist[19118, 8586]:= 3.562470 ;
let dist[19118, 8602]:= 1.790000 ;
let dist[8602, 3178]:= 6.276600 ;
let dist[8602, 16030]:= 5.254300 ;
let dist[8602, 27104]:= 5.227130 ;
let dist[8602, 2118]:= 3.399940 ;
let dist[8602, 3291]:= 4.307130 ;
let dist[8602, 1581]:= 3.570000 ;
let dist[8602, 14400]:= 3.770000 ;
let dist[8602, 2613]:= 3.190000 ;
let dist[8602, 2341]:= 2.850000 ;
let dist[8602, 15410]:= 2.820000 ;
let dist[8602, 2490]:= 3.390000 ;
let dist[8602, 2078]:= 3.232600 ;
let dist[8602, 1583]:= 3.500000 ;
let dist[8602, 31232]:= 3.352470 ;
let dist[8602, 8425]:= 3.032470 ;
let dist[8602, 31121]:= 2.500000 ;
let dist[8602, 31277]:= 2.390000 ;
let dist[8602, 2159]:= 3.062600 ;
let dist[8602, 10737]:= 2.816530 ;
let dist[8602, 31098]:= 2.500000 ;
let dist[8602, 8529]:= 3.500000 ;
```

```
let dist[8602, 8142]:= 1.370000 ;
let dist[8602, 13665]:= 1.230000 ;
let dist[8602, 8586]:= 3.020000 ;
let dist[8602, 19118]:= 1.350000 ;
```

Annex 4: PRENOT_GG1.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=3;

param cap :=3;

param tprima :=0;

param tseconda :=301;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7 8 9 10 11 12;

set PKUP := 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.175278    3178  2     102   20
2     0.149667    2159  2     170   20
3     0.151567    8425  2     279   20
4     0.122454    8425  2     394   20
5     0.131308    8602  2     405   20
6     0.164600    27104 28    441   20
7     0.113529    10737 2     536   20
8     0.114111    2341  2     641   20
9     0.135111    27104 28    673   20
10    0.147167    10737 2     685   20
11    0.122806    10737 2     756   20
12    0.135111    27104 28    762   20
13    0.958500    2118  2     52    20
14    0.981694    15410 39    10    20
15    0.960806    2118  2     184   20
16    0.975222    2613  2     184   20
17    0.988237    2490  182   235   20
18    0.961037    14400 169   238   20
19    0.983633    15410 235   279   20
20    0.912617    14400 290   313   20
21    0.970458    14400 290   334   20
22    0.956717    2490  346   416   20
23    0.985758    15410 235   451   20
24    0.957213    15410 235   511   20
25    0.981639    15410 235   549   20
26    0.956944    2118  2     572   20
27    0.983778    2490  450   604   20;
```

Annex 5: PRENOT_GG2.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=3;

param cap :=1;

param tprima :=0;

param tseconda :=301;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7;

set PKUP := 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.141083    3178  2     126   20
2     0.131167    10737 2     171   20
3     0.113175    8425  2     198   20
4     0.122454    8425  2     303   20
5     0.116575    10737 2     308   20
6     0.122454    8425  2     515   20
7     0.136278    10737 2     620   20
8     0.944333    31232 2     29    20
9     0.961222    1581  2     39    20
10    0.983139    31277 2     102   20
11    0.982611    31277 2     103   20
12    0.943889    1581  2     179   20
13    0.983633    15410 99    217   20
14    0.978321    31277 266   303   20
15    0.984483    1581  2     421   20
16    0.983633    15410 371   461   20
17    0.942338    31277 460   479   20
18    0.965075    1581  472   540   20
19    0.972222    1581  579   649   20
20    0.975583    31277 559   693   20
21    0.946361    31232 641   723   20
22    0.937944    31277 706   752   20;
```

Annex 6: PRENOT_GG3.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=3;

param cap :=3;

param tprima :=0;

param tseconda :=301;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6;

set PKUP := 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.103444    31121 2     44    20
2     0.177722    3178  2     180   20
3     0.125925    8425  2     244   20
4     0.127483    3178  2     421   20
5     0.135488    2118  79    521   20
6     0.127472    3178  2     550   20
7     0.983139    31277 2     59    20
8     0.981639    15410 2     163   20
9     0.987944    27104 2     170   20
10    0.973504    27104 2     187   20
11    0.956717    2490  55    234   20
12    0.988237    2490  55    281   20
13    0.943187    27104 2     345   20
14    0.983633    15410 281   365   20
15    0.986892    3291  168   416   20
16    0.985758    15410 281   418   20
17    0.983633    15410 281   463   20
18    0.985758    15410 281   508   20
19    0.961972    15410 594   620   20
20    0.952611    10737 2     694   20
21    0.987944    27104 416   702   20
22    0.982722    3291  700   732   20;
```

Annex 7: PRENOT_GG4.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=4;

param cap :=4;

param tprima :=0;

param tseconda :=301;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7 8 9 10 11 12 13 14;

set PKUP := 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.128971    16030 2     252   20
2     0.156454    16030 2     272   20
3     0.132300    16030 2     306   20
4     0.129113    8142  2     336   20
5     0.111050    31121 2     339   20
6     0.132300    16030 2     411   20
7     0.122454    8425  2     420   20
8     0.146608    2118  118   456   20
9     0.121817    2078  2     497   20
10    0.124792    8425  2     527   20
11    0.127778    2118  118   578   20
12    0.127472    3178  2     586   20
13    0.136944    8425  2     607   20
14    0.142139    8602  2     655   20
15    0.982611    31277 2     25    20
16    0.946500    31277 2     50    20
17    0.968889    14400 2     127   20
18    0.983139    31277 2     146   20
19    0.971750    1581  2     182   20
20    0.966067    31277 169   188   20
21    0.978675    2613  2     212   20
22    0.978321    31277 210   222   20
23    0.985971    31277 210   226   20
24    0.967200    1581  2     448   20
25    0.988237    2490  142   488   20
26    0.975222    2613  220   593   20
27    0.983028    2490  142   643   20
28    0.983139    31277 639   693   20
29    0.973861    1581  680   765   20;
```

Annex 8: PRENOT_GG5.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=3;

param cap :=1;

param tprima :=0;

param tseconda :=301;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7 8 9 10 11;

set PKUP := 12 13 14 15 16 17 18 19 20 21 22 23 24;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.143806    16030 2     130   20
2     0.133717    2078  2     215   20
3     0.146042    3178  2     229   20
4     0.126279    31121 2     242   20
5     0.142783    16030 2     301   20
6     0.127483    3178  2     306   20
7     0.130458    31121 2     313   20
8     0.127413    14400 227   431   20
9     0.128971    16030 2     482   20
10    0.146963    16030 2     534   20
11    0.149194    3291  242   593   20
12    0.982611    31277 2     38    20
13    0.961056    27104 2     131   20
14    0.943889    1581  2     157   20
15    0.985971    31277 44    232   20
16    0.943187    27104 2     235   20
17    0.969854    27104 2     243   20
18    0.975771    8425  2     264   20
19    0.965075    1581  2     392   20
20    0.986962    27104 2     459   20
21    0.978321    31277 44    531   20
22    0.959694    8425  474   630   20
23    0.975583    31277 44    688   20
24    0.945889    8425  739   784   20;
```

Annex 9: PRENOT_GG6.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=3;

param cap :=3;

param tprima :=0;

param tseconda :=301;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7 8;

set PKUP := 9 10 11 12 13 14 15;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.139667    2078  2     74    20
2     0.120258    8142  2     202   20
3     0.147813    8425  2     327   20
4     0.130600    14400 3     335   20
5     0.130742    2078  2     456   20
6     0.120258    8142  2     502   20
7     0.133139    8425  2     556   20
8     0.133139    8425  2     669   20
9     0.982611    31277 2     33    20
10    0.982722    3291  2     133   20
11    0.928100    27104 2     215   20
12    0.985758    15410 29    236   20
13    0.952892    3291  2     276   20
14    0.971662    10737 2     292   20
15    0.960046    15410 359   402   20;
```

Annex 10: PRENOT_GG7.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=3;

param cap :=3;

param tprima :=0;

param tseconda :=301;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7 8;

set PKUP := 9 10 11 12 13 14 15 16 17;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.143806    16030 2     8     20
2     0.115861    8425  2     121   20
3     0.137896    2078  2     183   20
4     0.138958    15410 69    332   20
5     0.165662    3178  2     356   20
6     0.117425    31121 2     382   20
7     0.159217    15410 69    401   20
8     0.131946    2490  30    486   20
9     0.982611    31277 2     74    20
10    0.987944    27104 2     101   20
11    0.973504    27104 149   213   20
12    0.978675    2613  2     249   20
13    0.972442    2613  2     301   20
14    0.986962    27104 403   425   20
15    0.984696    31277 247   468   20
16    0.976472    2118  2     553   20
17    0.947833    14400 299   633   20;
```

Annex 11: PRENOT_GG8.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=3;

param cap :=3;

param tprima :=0;

param tseconda :=301;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7 8 9 10;

set PKUP := 11 12 13 14 15 16 17 18 19 20 21;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.153111    16030 2     9     20
2     0.166028    2341  2     107   20
3     0.150722    8602  2     122   20
4     0.127483    3178  2     226   20
5     0.130600    14400 144   227   20
6     0.152346    8529  2     316   20
7     0.123233    8529  2     394   20
8     0.110696    15410 386   478   20
9     0.128971    16030 2     505   20
10    0.114056    15410 386   676   20
11    0.982722    3291  2     31    20
12    0.981694    15410 2     105   20
13    0.966000    31232 2     155   20
14    0.978675    2613  2     197   20
15    0.985758    15410 2     267   20
16    0.964225    2118  2     295   20
17    0.935963    27104 2     395   20
18    0.985971    31277 195   429   20
19    0.977583    31277 650   663   20
20    0.946361    31232 241   689   20
21    0.974417    27104 544   763   20;
```

Annex 12: PRENOT_GG9.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=3;

param cap :=1;

param tprima :=0;

param tseconda :=301;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7;

set PKUP := 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.136139    8425  2     80    20
2     0.136361    8602  2     165   20
3     0.132361    10737 2     169   20
4     0.131379    8602  2     203   20
5     0.121958    8529  2     204   20
6     0.113528    2490  40    647   20
7     0.157528    8425  2     720   20
8     0.981694    15410 2     45    20
9     0.948500    31232 2     58    20
10    0.981694    15410 2     146   20
11    0.986639    3291  2     180   20
12    0.965287    15410 2     200   20
13    0.978321    31277 2     266   20
14    0.986892    3291  227   280   20
15    0.955654    14400 2     282   20
16    0.948571    31232 2     307   20
17    0.974708    1581  322   396   20
18    0.957213    15410 301   428   20
19    0.952537    14400 423   433   20
20    0.965287    15410 301   511   20
21    0.973861    1581  413   635   20
22    0.961972    15410 655   685   20;
```

Annex 13: PRENOT_GG10.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=3;

param cap :=3;

param tprima :=0;

param tseconda :=301;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7 8 9 10 11;

set PKUP := 12 13 14 15 16 17 18 19 20 21 22;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.132361    10737 2     47    20
2     0.127483    3178  2     190   20
3     0.128688    8425  2     204   20
4     0.128121    2118  89    346   20
5     0.125358    2118  89    377   20
6     0.132088    10737 2     445   20
7     0.136196    2078  2     460   20
8     0.144111    2078  2     544   20
9     0.130528    16030 2     545   20
10    0.136694    8586  2     653   20
11    0.127972    8425  2     774   20
12    0.983778    2490  2     22    20
13    0.952472    2490  2     92    20
14    0.982611    31277 2     156   20
15    0.978321    31277 2     248   20
16    0.956788    31232 2     340   20
17    0.956717    2490  233   415   20
18    0.985758    15410 152   427   20
19    0.985971    31277 335   490   20
20    0.985758    15410 489   498   20
21    0.969139    14400 410   625   20
22    0.981694    15410 489   650   20;
```

Annex 14: PRENOT_GG11.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=3;

param cap :=1;

param tprima :=0;

param tseconda :=800;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7 8;

set PKUP := 9 10 11 12 13 14 15 16 17 18;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.175500    16030 2     111   20
2     0.134528    8602  2     168   20
3     0.116575    10737 2     184   20
4     0.128404    2341  2     219   20
5     0.142854    10737 2     297   20
6     0.123729    8602  2     331   20
7     0.129821    2341  2     521   20
8     0.150504    2078  2     533   20
9     0.981694    15410 2     41    20
10    0.975222    2613  2     130   20
11    0.986639    3291  2     159   20
12    0.978675    2613  2     202   20
13    0.986962    27104 221   315   20
14    0.970458    14400 2     377   20
15    0.973504    27104 221   399   20
16    0.957708    14400 2     479   20
17    0.931712    27104 221   483   20
18    0.950750    27104 598   622   20;
```

Annex 15: PRENOT_GG12.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=3;

param cap :=1;

param tprima :=0;

param tseconda :=800;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6;

set PKUP := 7 8 9 10 11 12 13 14 15 16 17 18;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.175278    3178  2     115   20
2     0.165944    3178  2     136   20
3     0.117425    31121 2     220   20
4     0.152558    16030 2     241   20
5     0.142783    16030 2     340   20
6     0.149694    2490  177   704   20
7     0.981694    15410 121   182   20
8     0.974708    1581  2     240   20
9     0.985758    15410 121   330   20
10    0.957213    15410 376   400   20
11    0.986962    27104 238   440   20
12    0.984483    1581  2     452   20
13    0.957708    14400 395   508   20
14    0.954778    15410 503   569   20
15    0.951444    14400 555   575   20
16    0.981639    15410 503   665   20
17    0.942611    1581  2     760   20
18    0.945889    8425  2     761   20;
```

Annex 16: PRENOT_GG13.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=3;

param cap :=1;

param tprima :=0;

param tseconda :=301;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7 8 9 10 11 12;

set PKUP := 13 14 15 16 17 18 19 20 21 22 23 24 25;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.157722    2341  1     1     20
2     0.136361    8602  2     102   20
3     0.133417    10737 2     144   20
4     0.115861    8425  2     175   20
5     0.125146    2078  2     202   20
6     0.145758    3178  2     208   20
7     0.142217    8425  2     260   20
8     0.126633    3291  114   344   20
9     0.134354    14400 317   425   20
10    0.117921    2341  2     468   20
11    0.137542    10737 2     513   20
12    0.135444    14400 317   607   20
13    0.970278    2613  2     12    20
14    0.978675    2613  2     196   20
15    0.976904    1581  2     223   20
16    0.943187    27104 169   325   20
17    0.984696    31277 287   367   20
18    0.967696    2118  2     398   20
19    0.973504    27104 485   527   20
20    0.975222    2613  2     586   20
21    0.954778    15410 362   610   20
22    0.955778    2613  2     616   20
23    0.952361    2613  2     661   20
24    0.960806    2118  2     678   20
25    0.946972    2118  2     789   20;
```

Annex 17: PRENOT_GG14.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=3;

param cap :=1;

param tprima :=0;

param tseconda :=800;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7 8 9 10 11 12;

set PKUP := 13 14 15 16 17 18;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.131167    10737 2     132   20
2     0.120194    10737 2     149   20
3     0.127483    3178  2     212   20
4     0.136408    27104 42    234   20
5     0.116575    10737 2     261   20
6     0.126633    8602  2     288   20
7     0.122454    8425  2     298   20
8     0.113175    8425  2     309   20
9     0.113175    8425  2     334   20
10    0.134142    16030 2     389   20
11    0.108429    15410 413   455   20
12    0.127472    3178  2     621   20
13    0.971750    1581  2     51    20
14    0.951444    14400 2     138   20
15    0.958861    14400 2     163   20
16    0.972513    31232 2     273   20
17    0.972513    31232 2     543   20
18    0.952611    10737 2     657   20;
```

Annex 18: PRENOT_GG15.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=3;

param cap :=1;

param tprima :=0;

param tseconda :=800;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5;

set PKUP := 6 7 8 9 10 11 12 13 14 15 16;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.131167    10737 2     168   20
2     0.126633    8602  2     198   20
3     0.138250    15410 240   378   20
4     0.149583    3178  2     614   20
5     0.149583    3178  2     643   20
6     0.981694    15410 2     34    20
7     0.966000    31232 2     64    20
8     0.970278    2613  2     78    20
9     0.930944    2613  2     197   20
10    0.986962    27104 2     289   20
11    0.950625    10737 2     295   20
12    0.978675    2613  2     303   20
13    0.928100    27104 2     434   20
14    0.973504    27104 486   506   20
15    0.975222    2613  311   608   20
16    0.952611    10737 334   675   20;
```

Annex 19: PRENOT_GG16.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=4;

param cap :=4;

param tprima :=0;

param tseconda :=301;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7 8 9 10 11;

set PKUP := 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.122806    10737 2     97    20
2     0.136083    10737 2     166   20
3     0.143722    10737 2     168   20
4     0.143492    3178  2     190   20
5     0.109704    3291  27    373   20
6     0.125925    8425  2     401   20
7     0.121463    2341  2     436   20
8     0.146963    16030 2     497   20
9     0.157528    8425  2     630   20
10    0.170556    3178  2     674   20
11    0.114111    2341  2     738   20
12    0.981639    15410 2     13    20
13    0.947472    14400 2     45    20
14    0.958861    14400 2     98    20
15    0.968889    14400 2     174   20
16    0.988237    2490  2     238   20
17    0.978675    2613  2     240   20
18    0.942762    14400 228   261   20
19    0.983633    15410 264   341   20
20    0.984483    1581  85    353   20
21    0.965925    14400 312   365   20
22    0.976904    1581  85    430   20
23    0.984625    2490  2     484   20
24    0.961972    15410 563   589   20
25    0.971750    1581  541   616   20
26    0.983028    2490  2     698   20
27    0.942333    2613  578   747   20;
```

Annex 20: PRENOT_GG17.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=4;

param cap :=4;

param tprima :=0;

param tseconda :=301;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16;

set PKUP := 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.131592    14400 39    188   20
2     0.135842    8425  2     203   20
3     0.142854    10737 2     278   20
4     0.124154    14400 39    371   20
5     0.132796    27104 235   383   20
6     0.122950    10737 2     427   20
7     0.116079    8142  2     476   20
8     0.127413    14400 39    524   20
9     0.125925    8425  2     539   20
10    0.117500    14400 39    564   20
11    0.171389    27104 235   630   20
12    0.136278    10737 2     650   20
13    0.147889    8425  2     662   20
14    0.110028    27104 235   688   20
15    0.157861    8602  2     737   20
16    0.131167    10737 2     743   20
17    0.983139    31277 2     34    20
18    0.966000    31232 2     50    20
19    0.981778    1581  2     71    20
20    0.964417    31232 2     146   20
21    0.935778    31232 2     148   20
22    0.981639    15410 2     149   20
23    0.986892    3291  67    236   20
24    0.978675    2613  2     287   20
25    0.986892    3291  67    327   20
26    0.985758    15410 291   335   20
27    0.966067    31277 285   339   20
28    0.983633    15410 291   397   20
29    0.978675    2613  2     462   20
30    0.983633    15410 291   492   20
31    0.964417    31232 2     589   20;
```

Annex 21: PRENOT_GG18.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=3;

param cap :=1;

param tprima :=0;

param tseconda :=301;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7 8 9 10 11 12;

set PKUP := 13 14 15 16 17 18 19 20 21 22;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.127483    8142  2     241   20
2     0.149654    31121 2     267   20
3     0.136196    2078  2     319   20
4     0.153904    27104 215   418   20
5     0.151071    8425  2     462   20
6     0.113175    8425  2     487   20
7     0.143775    14400 173   518   20
8     0.135611    2118  49    584   20
9     0.141889    14400 173   597   20
10    0.110028    27104 215   657   20
11    0.133139    2078  2     682   20
12    0.136361    8602  2     758   20
13    0.981694    15410 2     18    20
14    0.948056    3291  2     191   20
15    0.964721    3291  240   281   20
16    0.983633    15410 143   293   20
17    0.950908    2613  2     347   20
18    0.966067    2490  14    423   20
19    0.959267    15410 143   458   20
20    0.983633    15410 143   467   20
21    0.982611    31277 466   604   20
22    0.981639    15410 620   663   20;
```

Annex 22: PRENOT_GG19.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=3;

param cap :=1;

param tprima :=0;

param tseconda :=800;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7;

set PKUP := 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.166028    2341  2     85    20
2     0.142111    31121 2     141   20
3     0.165944    3178  2     155   20
4     0.144556    2341  2     159   20
5     0.145263    15410 2     312   20
6     0.110696    15410 2     342   20
7     0.114056    15410 2     584   20
8     0.968889    14400 2     23    20
9     0.928917    27104 2     26    20
10    0.983139    31277 2     92    20
11    0.968889    14400 2     138   20
12    0.970458    14400 2     185   20
13    0.935963    27104 2     190   20
14    0.945737    2118  2     228   20
15    0.970458    14400 249   284   20
16    0.966067    31277 2     340   20
17    0.986962    27104 365   372   20
18    0.957567    2118  284   405   20
19    0.980092    2118  284   442   20
20    0.984696    31277 508   524   20
21    0.951444    14400 337   645   20
22    0.964417    31277 716   739   20;
```

Annex 23: PRENOT_GG20.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=3;

param cap :=1;

param tprima :=0;

param tseconda :=800;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7 8;

set PKUP := 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.145758    3178  2     262   20
2     0.162971    3178  2     291   20
3     0.128050    8425  2     473   20
4     0.120967    2341  2     537   20
5     0.124917    27104 266   574   20
6     0.143917    16030 2     604   20
7     0.149694    2490  141   608   20
8     0.157528    8425  2     747   20
9     0.981639    15410 2     10    20
10    0.953250    2118  2     132   20
11    0.968889    14400 2     153   20
12    0.951444    14400 2     157   20
13    0.981694    15410 2     170   20
14    0.970033    2118  2     221   20
15    0.962312    10737 2     224   20
16    0.957708    14400 220   234   20
17    0.974708    1581  2     269   20
18    0.985758    15410 229   353   20
19    0.957213    15410 229   361   20
20    0.971733    14400 356   434   20
21    0.957708    14400 356   509   20
22    0.985758    15410 504   516   20
23    0.975583    31277 395   603   20
24    0.974222    10737 578   708   20
25    0.971750    1581  701   767   20;
```

Annex 24: PRENOT_GG21.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=4;

param cap :=4;

param tprima :=0;

param tseconda :=301;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16;

set PKUP := 17 18 19 20 21 22 23 24 25 26 27 28;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.147889    8425  2     21    20
2     0.162121    3178  2     300   20
3     0.133008    8586  2     337   20
4     0.153904    27104 137   366   20
5     0.165804    27104 137   445   20
6     0.137542    10737 2     445   20
7     0.146467    27104 137   484   20
8     0.136763    8529  2     531   20
9     0.142642    8142  2     535   20
10    0.135111    27104 137   596   20
11    0.130528    16030 2     609   20
12    0.135111    27104 137   634   20
13    0.127472    3178  2     656   20
14    0.155250    8586  2     677   20
15    0.130528    16030 2     706   20
16    0.133806    8142  2     725   20
17    0.975583    31277 2     93    20
18    0.971750    1581  2     146   20
19    0.947472    14400 2     165   20
20    0.981639    15410 2     175   20
21    0.984625    2490  2     204   20
22    0.988237    2490  2     211   20
23    0.988237    2490  2     274   20
24    0.950908    2613  86    301   20
25    0.985758    15410 274   313   20
26    0.957213    15410 274   318   20
27    0.985758    15410 274   413   20
28    0.975222    2613  86    567   20;
```

Annex 25: PRENOT_GG22.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=3;

param cap :=1;

param tprima :=0;

param tseconda :=301;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7 8;

set PKUP := 9 10 11 12 13 14 15 16 17 18 19 20 21;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.153111    16030 2     6     20
2     0.120194    10737 2     129   20
3     0.149583    3178  2     153   20
4     0.109208    8529  2     208   20
5     0.124225    14400 40    248   20
6     0.129139    10737 2     628   20
7     0.147889    8425  2     706   20
8     0.120194    10737 2     755   20
9     0.987944    27104 2     98    20
10    0.920306    27104 2     123   20
11    0.981694    15410 2     171   20
12    0.983633    15410 183   279   20
13    0.966846    15410 183   303   20
14    0.973504    27104 158   322   20
15    0.983633    15410 331   378   20
16    0.973504    27104 158   501   20
17    0.985758    15410 477   525   20
18    0.939083    27104 158   562   20
19    0.981694    15410 558   565   20
20    0.958861    14400 373   637   20
21    0.968889    14400 373   748   20;
```

Annex 26: PRENOT_GG23.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=3;

param cap :=1;

param tprima :=0;

param tseconda :=301;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7 8 9;

set PKUP := 10 11 12 13 14 15 16 17 18;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.127472    3178  2     124   20
2     0.175500    16030 2     170   20
3     0.168567    2490  84    303   20
4     0.136196    2078  2     308   20
5     0.112183    2341  2     520   20
6     0.139808    8529  2     523   20
7     0.143917    16030 2     546   20
8     0.175278    3178  2     621   20
9     0.170556    3178  2     768   20
10    0.982611    31277 2     13    20
11    0.943556    27104 2     178   20
12    0.985758    15410 9     215   20
13    0.949987    31277 218   241   20
14    0.976904    1581  2     253   20
15    0.957708    14400 2     270   20
16    0.985971    31277 218   349   20
17    0.951404    1581  2     489   20
18    0.957000    31277 628   719   20;
```

Annex 27: PRENOT_GG24.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=3;

param cap :=1;

param tprima :=0;

param tseconda :=800;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7;

set PKUP := 8 9 10 11 12 13 14 15 16 17 18 19;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.124556    2078  2     27    20
2     0.139667    2078  2     176   20
3     0.128971    16030 2     246   20
4     0.147671    8586  2     353   20
5     0.119479    10737 2     379   20
6     0.114972    2490  56    542   20
7     0.122806    10737 2     644   20
8     0.966000    31232 2     142   20
9     0.928917    27104 2     144   20
10    0.978675    2613  2     212   20
11    0.961675    27104 185   222   20
12    0.974212    14400 132   247   20
13    0.986892    3291  2     249   20
14    0.955017    27104 249   435   20
15    0.955654    14400 355   441   20
16    0.985758    15410 176   521   20
17    0.956944    2118  67    567   20
18    0.976472    2118  67    591   20
19    0.986639    3291  2     637   20;
```

Annex 28: PRENOT_GG25.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=3;

param cap :=1;

param tprima :=0;

param tseconda :=301;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7 8 9;

set PKUP := 10 11 12 13 14 15 16;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.136763    2078  2     187   20
2     0.116433    14400 285   349   20
3     0.126633    3291  143   426   20
4     0.131379    8602  2     450   20
5     0.119479    10737 2     491   20
6     0.148833    8602  2     572   20
7     0.131167    10737 2     583   20
8     0.132361    10737 2     668   20
9     0.114056    15410 583   676   20
10    0.966000    31232 2     30    20
11    0.981694    15410 2     104   20
12    0.982611    31277 2     153   20
13    0.966067    31277 2     289   20
14    0.953883    31277 336   370   20
15    0.978321    31277 336   386   20
16    0.980092    2118  2     395   20;
```

Annex 29: PRENOT_GG26.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=3;

param cap :=1;

param tprima :=0;

param tseconda :=301;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7 8 9 10 11;

set PKUP := 12 13 14 15 16 17 18 19 20 21 22;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.124167    8142  2     105   20
2     0.114111    2341  2     138   20
3     0.124154    31277 118   319   20
4     0.127554    15410 227   345   20
5     0.119479    10737 2     390   20
6     0.121958    27104 243   404   20
7     0.146467    27104 243   413   20
8     0.134992    10737 2     475   20
9     0.109861    2078  2     649   20
10    0.139861    10737 2     712   20
11    0.136472    2078  2     749   20
12    0.981694    15410 2     54    20
13    0.964417    31232 2     66    20
14    0.983778    2490  50    147   20
15    0.983778    2490  50    157   20
16    0.959125    2490  50    196   20
17    0.988237    2490  50    228   20
18    0.986892    3291  2     244   20
19    0.952892    3291  2     261   20
20    0.986892    3291  2     300   20
21    0.983028    2490  487   642   20
22    0.982722    3291  2     725   20;
```

Annex 30: PRENOT_GG27.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=4;

param cap :=4;

param tprima :=0;

param tseconda :=301;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7 8 9 10 11 12;

set PKUP := 13 14 15 16 17 18 19 20 21 22 23 24 25 26;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.131167    10737 2     76    20
2     0.143917    16030 2     101   20
3     0.127472    3178  2     144   20
4     0.120188    8142  2     235   20
5     0.161342    3178  2     241   20
6     0.117921    2341  2     440   20
7     0.138958    15410 322   451   20
8     0.137542    10737 2     530   20
9     0.132583    8529  2     622   20
10    0.127500    10737 2     640   20
11    0.114944    2613  44    699   20
12    0.143667    10737 2     743   20
13    0.981778    1581  2     29    20
14    0.981694    15410 2     137   20
15    0.969139    14400 2     141   20
16    0.978321    31277 2     213   20
17    0.978746    14400 2     227   20
18    0.965925    14400 2     269   20
19    0.986962    27104 2     305   20
20    0.988237    2490  133   323   20
21    0.962737    27104 2     393   20
22    0.956717    2490  133   463   20
23    0.970458    14400 458   513   20
24    0.981639    15410 342   648   20
25    0.944333    31232 2     726   20
26    0.981639    15410 342   728   20;
```

Annex 31: PRENOT_GG28.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=3;

param cap :=3;

param tprima :=0;

param tseconda :=301;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7 8 9 10 11;

set PKUP := 12 13 14 15 16 17 18 19 20 21 22 23 24;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.124556    2078  2     11    20
2     0.112333    31121 2     68    20
3     0.133583    2341  2     122   20
4     0.162829    8425  2     204   20
5     0.177633    3178  2     288   20
6     0.131025    10737 2     310   20
7     0.128121    2118  262   373   20
8     0.161342    3178  2     447   20
9     0.134992    10737 2     539   20
10    0.168528    27104 570   603   20
11    0.110028    27104 570   705   20
12    0.946361    31232 2     20    20
13    0.981694    15410 2     164   20
14    0.954778    15410 2     172   20
15    0.985971    31277 3     238   20
16    0.962737    27104 134   336   20
17    0.985758    15410 249   403   20
18    0.968475    31232 2     410   20
19    0.986892    3291  2     457   20
20    0.957708    14400 158   480   20
21    0.986639    3291  2     574   20
22    0.944333    31232 513   601   20
23    0.942333    2613  2     643   20
24    0.968889    14400 158   721   20;
```

Annex 32: PRENOT_GG29.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44


param K :=3;

param cap :=3;

param tprima :=0;

param tseconda :=301;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7 8 9 10;

set PKUP := 11 12 13 14 15 16 17 18 19 20 21 22 23;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.136139    8425  2     56    20
2     0.149667    2159  2     90    20
3     0.143806    16030 2     144   20
4     0.121639    2341  2     179   20
5     0.127129    3178  2     204   20
6     0.145758    3178  2     248   20
7     0.126633    8602  2     268   20
8     0.117425    31121 2     389   20
9     0.117500    14400 536   621   20
10    0.114056    15410 628   767   20
11    0.982611    31277 2     41    20
12    0.969139    14400 2     139   20
13    0.982611    31277 2     162   20
14    0.956788    31232 2     193   20
15    0.985971    31277 188   227   20
16    0.972513    31232 2     294   20
17    0.950200    31232 2     347   20
18    0.985971    31277 188   362   20
19    0.978321    31277 406   417   20
20    0.975583    31277 505   574   20
21    0.936417    31232 454   650   20
22    0.960194    8602  2     660   20
23    0.975583    31277 505   705   20;
```

Annex 33: PRENOT_GG30.dat

```
set V := 1500..33270;

set PARKING := 3178 16030 27104 2118 3291 1581 14400 2613 2341 15410
2490 2078 1583 31232 8425 31121 31277 2159 10737 31098 8529 8142 13665
8586 19118 8602;

# C1 - Piazza Mar Egeo (Via Cozzi - Via Polvani)
# C2 - Via Durando, 10
# C3 - Via Pacini, 74/F.S. Lambrate
# C4 - Via Taramelli, 2/Pola
# C5 - Piazza L. Da Vinci angolo Via AmpËre
# C6 - Corso Plebisciti, 1
# C7 - Via Sarfatti, 23
# C8 - Via Tortona angolo Bergognone, 30
# C9 - Corso Cristoforo Colombo, 17
# C10 - Piazza 6 Febbraio, 24
# C11 - Piazza Amendola, 8
# C12 - Via Melchiorre Gioia, 39
# C13 - Corso Indipendenza, 23
# C14 - Via Freguglia (sinistra Tribunale)
# C15 - Largo Richini
# C16 - Piazza G. Cantore, 2
# C17 - Via Pagano, 69
# C18 - Via Sassetti
# C19 - Via Manin, 37
# C20 - Corso Monforte, 40
# C21 - Largo Bersaglieri D'Italia
# C22 - Largo Gemelli
# C23 - Via Metastasio, 5
# C24 - Via Case Rotte/Largo Mattioli
# C25 - Piazza Edison
# C26 - Via Broletto, 44

param K :=3;

param cap :=3;

param tprima :=0;

param tseconda :=301;

param T :=300;

param dep := 3291;

set DVRY := 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15;

set PKUP := 16 17 18 19 20 21 22 23 24;
```

```
param:      R           P     TAU_MIN     TAU_MAX     rev :=
1     0.143806    16030 2     17    20
2     0.115861    8425  2     47    20
3     0.144556    2341  2     143   20
4     0.110696    15410 126   203   20
5     0.108429    15410 126   225   20
6     0.108429    15410 126   261   20
7     0.114663    31121 2     288   20
8     0.137542    10737 2     317   20
9     0.131025    10737 2     317   20
10    0.147813    8425  2     396   20
11    0.124933    15410 126   443   20
12    0.139950    14400 402   494   20
13    0.138958    15410 126   506   20
14    0.154056    15410 126   656   20
15    0.150444    8425  2     681   20
16    0.975583    31277 2     108   20
17    0.981694    15410 2     114   20
18    0.982611    31277 2     128   20
19    0.982611    31277 2     131   20
20    0.936417    31232 2     179   20
21    0.985971    31277 206   353   20
22    0.972513    31232 2     480   20
23    0.942338    31277 206   542   20
24    0.976472    2118  634   720   20;
```